Enabling Regional Climate Model Evaluation: A Critical Use of Observations for Establishing Core NCA Capabilities

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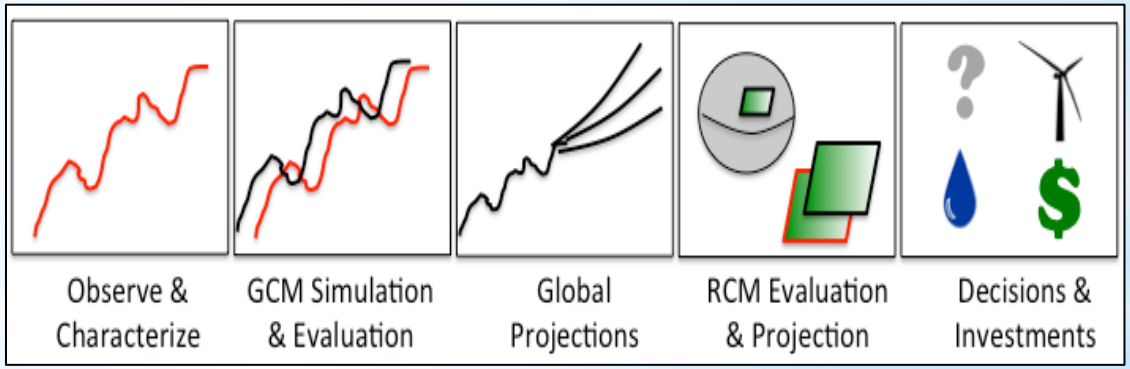
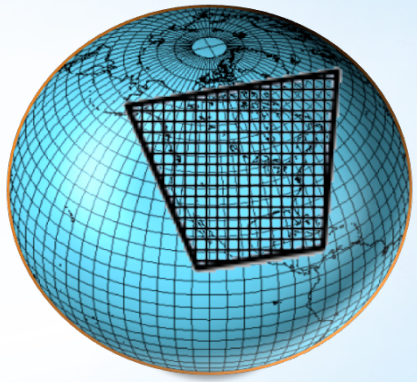


Response to: **NASA Center's Call for Proposals**

To Support The **National Climate Assessment**

PI Telecon : October 11, 2011



NASA JPL

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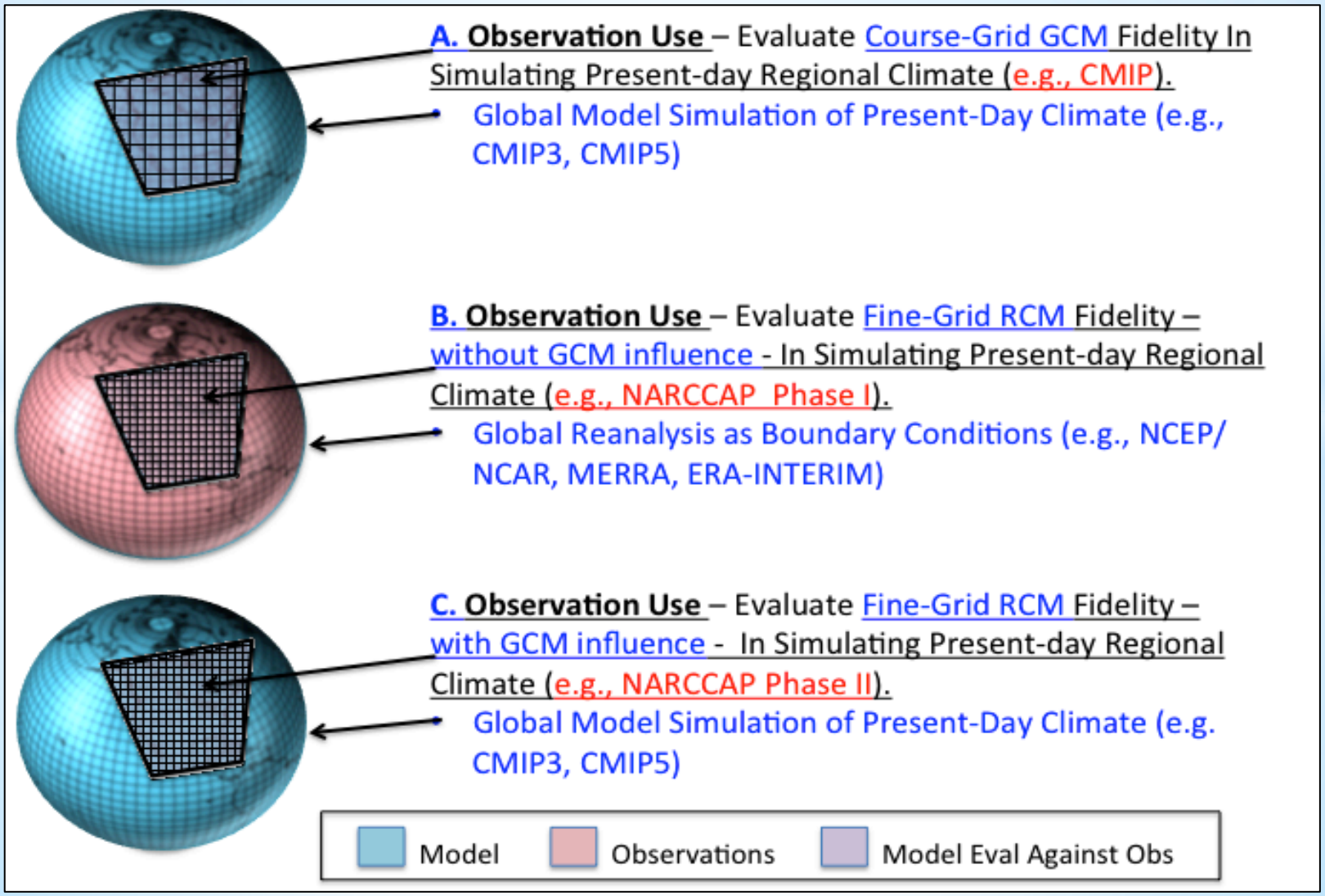
- Global Climate Models (GCMs) provide the only quantitative, physically-based means for predicting climate change.
- Regional climate models (RCMs) are a key tool to downscale the global predictions for characterizing and quantifying climate change impacts on scales relevant to decision-support and climate assessment activities (e.g. NCA).
- It is imperative that GCMs and RCMs are evaluated against observations so that their strengths and weaknesses can be quantified and model shortcomings can be improved.
- Systematic evaluation studies of GCMs have been undertaken for some time (e.g., AMIP, CMIP, CFMIP), however there has been less attention/consideration made to systematic evaluation of RCMs.
- NASA can provide critical and unique observational resources and technological leadership to facilitate RCM evaluation and thus make key contributions to the NCA process.

Using NASA Observations for model evaluation relevant to the NCA



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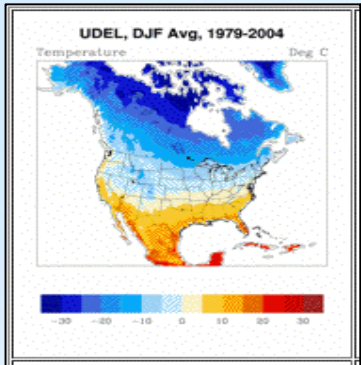
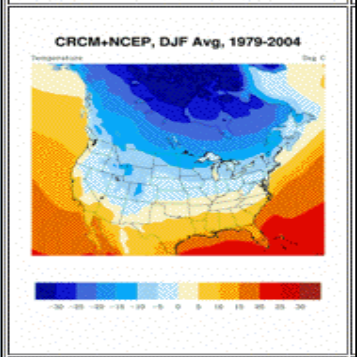
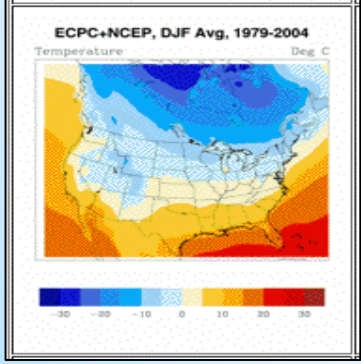
NARCCAP

North American Regional Climate Change Assessment Program







Regional Models

Model	Aliases	Modeling Group	Full Name
CRCM	MRCC	OURANOS / UQAM	Canadian Regional Climate Model / le Modèle Régional Canadien du Climat
ECPC	RSM	UC San Diego / Scripps	Experimental Climate Prediction Center Regional Spectral Model
HRM3	PRECIS, HadRM3	Hadley Centre	Hadley Regional Model 3 / Providing REgional Climates for Impact Studies
MM5I	MM5, MM5P*	Iowa State University	MM5 - PSU/NCAR mesoscale model
RCM3	RegCM3	UC Santa Cruz	Regional Climate Model version 3
WRFP	WRF	Pacific Northwest Nat'l Lab	Weather Research & Forecasting model

Drivers

Driver	Full Name	Ensemble Member Used
CCSM	Community Climate System Model	b30.030e (ctl), b30.042e (fut)
CGCM3	Third Generation Coupled Global Climate Model	CGCM #4
GFDL	Geophysical Fluid Dynamics Laboratory GCM	20C3M, run2; sresa2, run1
HadCM3	Hadley Centre Coupled Model, version 3	Custom run for NARCCAP
NCEP	NCEP/DOE AMIP-II Reanalysis	N/A

RCM / GCM combinations

	Phase I	Phase II			
	NCEP	GFDL	CGCM3	HADCM3	CCSM
CRCM	X		1		2
ECPC	X	1		2	
HRM3	X	2		1	
MM5I	X			2	1
RCM3	X	1	2		
WRFP	X		2		1
timeslice		X			X

1: First pairing to be run
2: Second pairing to be run

SPONSORS

NCAR

NOAA NSF

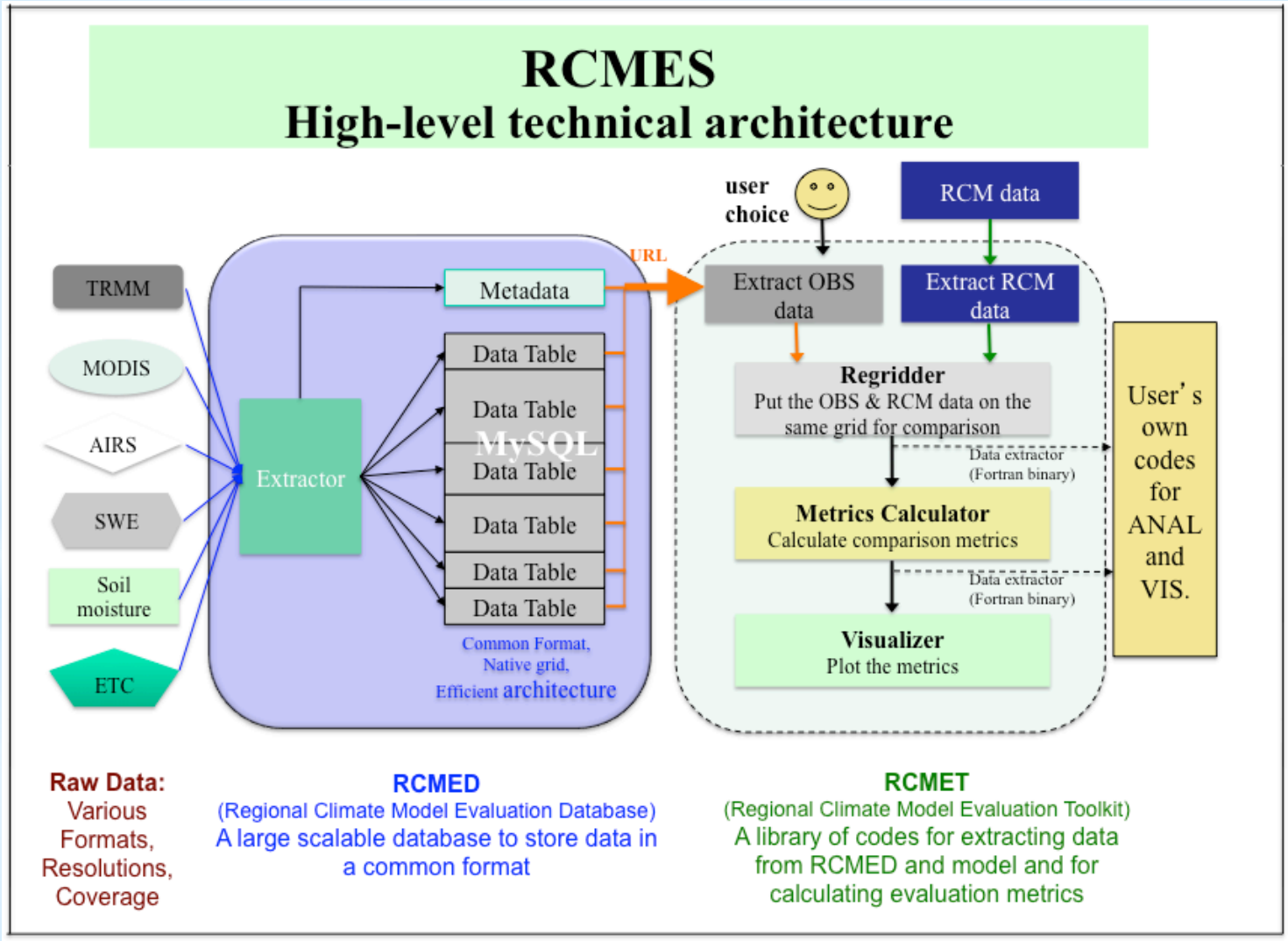
OURANOS

NARCCAP is the North America Regional Climate Change Assessment Program (PI: L. Mearns, NCAR).

Several RCMs downscaling future climate change projections from GCMs.

RCM performance needs to be characterized against observations using present-day simulations.

NARRCAP is the U.S./N.A. contribution to CORDEX.



Ingest obs/models, re-gridding, calculate metrics (e.g, bias, RMSE, correlation, significance, PDFs), and visualize results (e.g., contour, time series, Taylor).

RCMES
High-level technical architecture

AVAILABLE

- AIRS gridded daily 3D temperature and water vapor
- TRMM 3B42 3-hourly gridded daily precipitation
- ERA-Interim 6-hourly surface temperature & dewpoint, 3D temperature & geopotential
- NCEP daily Unified Rain gauge Database (URD), 0.25º resolution
- Satellite-based Snow Water Equivalent (SWE) assimilation data
- MODIS daily Cloud fraction
- Climate Research Units (CRU) monthly precipitation and temperature (Tavg, Tmin, Tmax) at 0.5 º resolution.

FUTURE

- CERES radiation, CloudSat atmospheric ice and liquid, MODIS snow cover, ISCCP cloud fraction, MERRA, etc.

Coverage

calculating evaluation metrics

Ingest obs/models, re-gridding, calculate metrics (e.g, bias, RMSE, correlation, significance, PDFs), and visualize results (e.g., contour, time series, Taylor).

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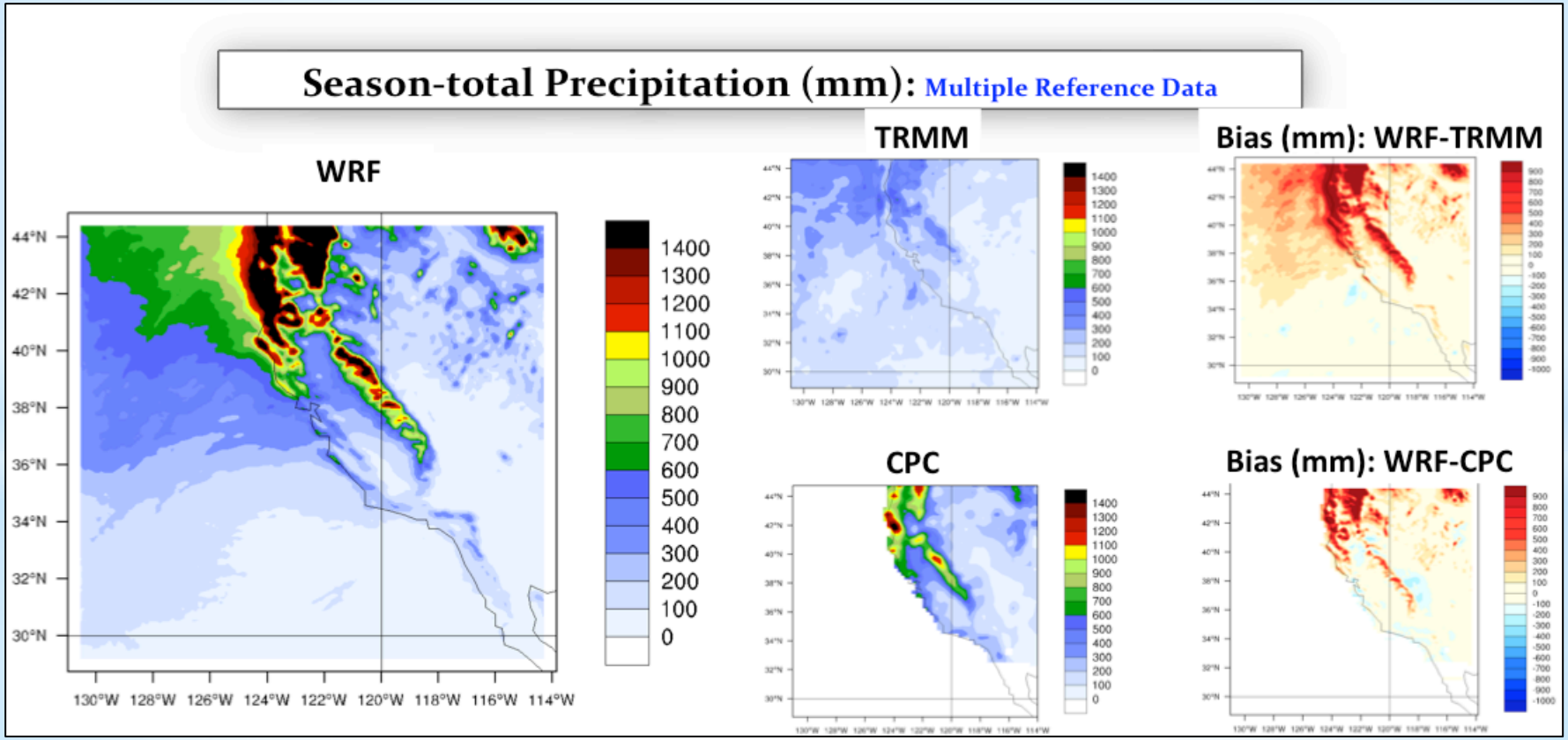
Example application over Southwest U.S.



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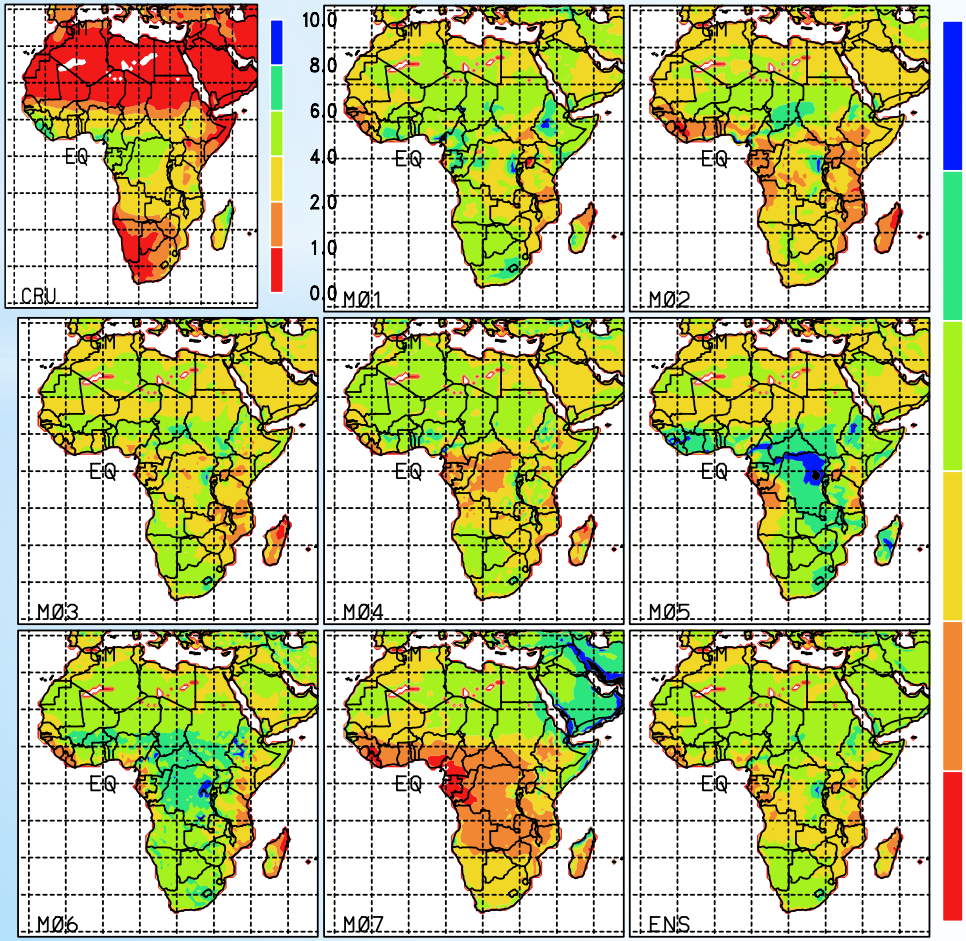
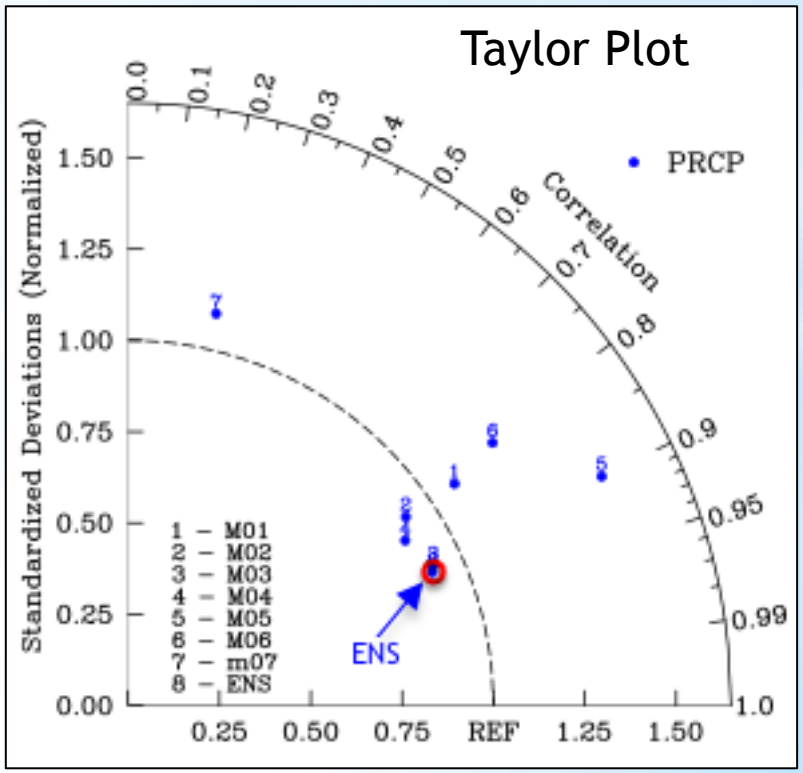
Example application for CORDEX-Africa

Bias: Annual-mean precipitation climatology (mm/day)

REF (mm/day): CRU



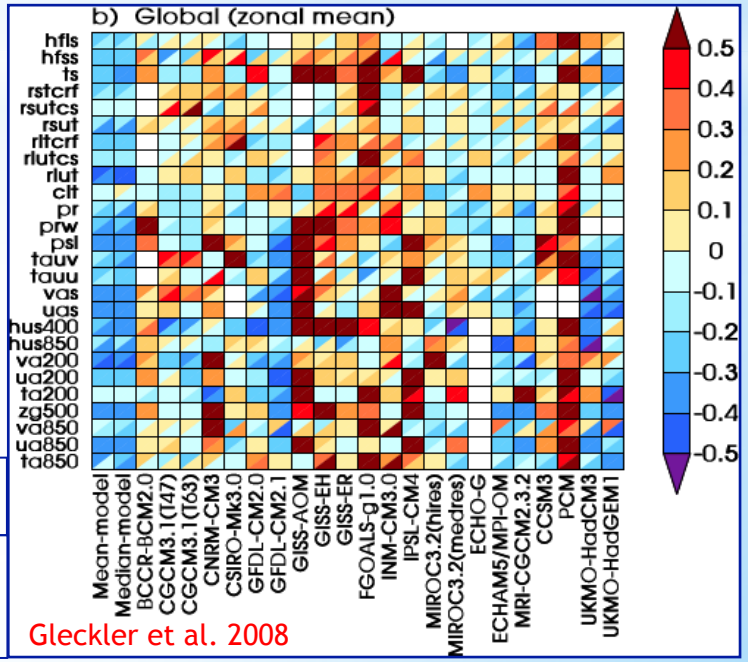


This activity includes three tasks:

I) Tailoring RCMES for application to the NCA. (e.g. data sets, metrics, visualization, GUI

II) Systematic application of observations to evaluate NARCCAP RCM and CMIP GCM simulations over the U.S./N. America.

III) Overall incorporation of model evaluation/assessment results and RCMES infrastructure into the near- and long-term NCA process.



GOAL

Observation-based model performance metrics for modeling regional climate.